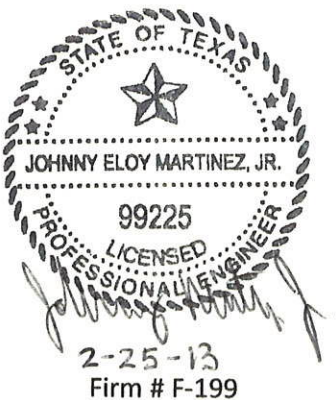




2013

Gateway International Bridge Annual Inspection Report



STRUCTURAL ENGINEERING
ASSOCIATES, INC.
CONSULTING ENGINEERS



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GATEWAY INTERNATIONAL BRIDGE ANNUAL INSPECTION REPORT

SUBMITTED TO:
CAMERON COUNTY
BROWNSVILLE, TEXAS

SUBMITTED BY:
STRUCTURAL ENGINEERING ASSOCIATES, INC.
SAN ANTONIO, TEXAS

FEBRUARY 25, 2013

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1 Introduction

Structural Engineering Associates, Inc. (SEA) has been retained by Cameron County to provide a structural inspection of the Gateway International Bridge located in Brownsville, Texas. There are actually two bridges at this site. One for south bound traffic and a separate bridge for north bound traffic. The purpose of this report is to give an overall summary of the structural condition of the bridges as they currently exist. The inspection was conducted on January 21, 2013 by Johnny Martinez, P.E., Ernest Meche, P.E. and Adrian Romero, P.E. The inspection included both the U.S. and Mexico sides of both bridges. The assessment given in the following pages is our opinion and is limited to what could be visually observed. Material and laboratory testing was not included. Also, not included were site surveys, structural analysis, recommendations for repairs and associated cost estimates. Note that bridge components located over the Rio Grande River which were not accessible were observed through binoculars only.

The process used to compile this report included the following activities:

1. Review of previous engineering reports and plans for the bridges.
2. On-site field investigation of the bridges.
3. Preparation and submittal of an inspection report.

The structural inspection includes all structural components of the bridges from abutment to abutment. The toll collecting facilities were not inspected and are not part of this report. This report often refers to span and bent numbers. See section 6, at the end of this report, for span and bent locations.

2 Bridge Description

The Gateway International Bridge consists of two separate bridges. The superstructure consists of a post-tensioned slab span with edge beams at spans 5 and 7 and prestressed concrete T-beam spans with post-tensioned concrete deck panels and diaphragms at spans 1 through 4 and spans 8 through 12.

The bridge concrete slab soffit consists of the T-beam top flanges, concrete between the T-beam top flanges, and T-beam overhangs with a narrow strip of cast-in-place concrete on the outer edges of the overhangs.

The substructures at the interior cap bents consist of cast-in-place concrete bent caps supported on approximately 11 feet 5 $\frac{3}{4}$ inch diameter, 11-7/8 inch thick concrete caissons/columns supported on deep circular footings.

Southbound Bridge (Mexico)



The southbound bridge is located upstream of the northbound bridge and is used for Mexico bound pedestrian and vehicular traffic. The overall length of the bridge is approximately 559'. The U.S. portion of this bridge extends from abutment 7 to the international boundary between bents 8 and 9. This distance is approximately 129'. The bridge has six spans, an asphalt overlay and two lanes of one-way traffic. There is an approximately 9' wide sidewalk on the west side of the bridge. A canopy has been constructed over the sidewalk on the Mexican portion only. There is an approximately 2.5' wide curb on the east side of the bridge. The east side of the bridge has a metal traffic rail, while the west

side has a metal canopy and pedestrian rail. A combination metal and concrete pedestrian rail is placed between the sidewalk and vehicular lanes.

Northbound Bridge (Mexico)



The northbound bridge is located downstream of the southbound bridge and is used for U.S. bound pedestrian and vehicular traffic. The overall length of the bridge is approximately 478'. The U.S. portion of this bridge extends from the international boundary near bent 4 to abutment 6. This distance is approximately 158'. The bridge has five spans and has an asphalt overlay and two lanes of one-way traffic. There is an approximately 9' wide sidewalk on the east side of the bridge. A canopy has been constructed over the sidewalk on the Mexican portion only. There is an approximately 2.5' wide curb on the west side of the bridge. The west side of the bridge has a metal traffic rail, while the east side has a metal canopy and pedestrian rail. A combination metal and concrete pedestrian rail is placed between the sidewalk and vehicular lanes.

On the day of our visit, pedestrian and vehicular traffic use on both bridges was high.

3 Structural Inspection (Upstream Bridge – Southbound)

3.1 Roadway – Top of Bridge

3.1.1 Bridge Deck

There are minimal visible cracks worth noting, the wear of the deck surface is average, and overall the deck appears to be in good condition. The asphalt overlay appears to be structurally adequate and the lane stripes are consistent and visible throughout the bridge. Figure 3.1.1–A shows an overall view of the deck while Figure 3.1.1–B shows the extent of transverse cracking found in the deck. These cracks are located on span 7 near the expansion joint at bent 8.

Figure 3.1.1–A (Mexico)



Figure 3.1.1–B (U.S.)



3.1.2 Bridge Joints

Expansion joints were only visible along the width of the roadway since the concrete curb and sidewalk covered them along the edges of the bridge. We are not able to inspect the expansion joints at abutment 7 and bent 8 since they are covered with asphalt overlay. The asphalt overlay at these joints restricts bridge movement which adds additional loading to the other bridge elements, thus potentially reducing their structural life. As for the remaining expansion joints, they are filled with debris; nonetheless appear to be in good condition. All joints are properly aligned and appear to be structurally adequate. Although there is notable damage to the curb and sidewalk at the expansion joint ends there is no visible damage to the joint alignments. Figure 3.1.2-A shows an example of an asphalt covered expansion joint. Figure 3.1.2-B shows a typical uncovered expansion joint. Figure 3.1.2-C shows end of expansion joint at damaged edge of sidewalk.

Figure 3.1.2–A (U.S.)

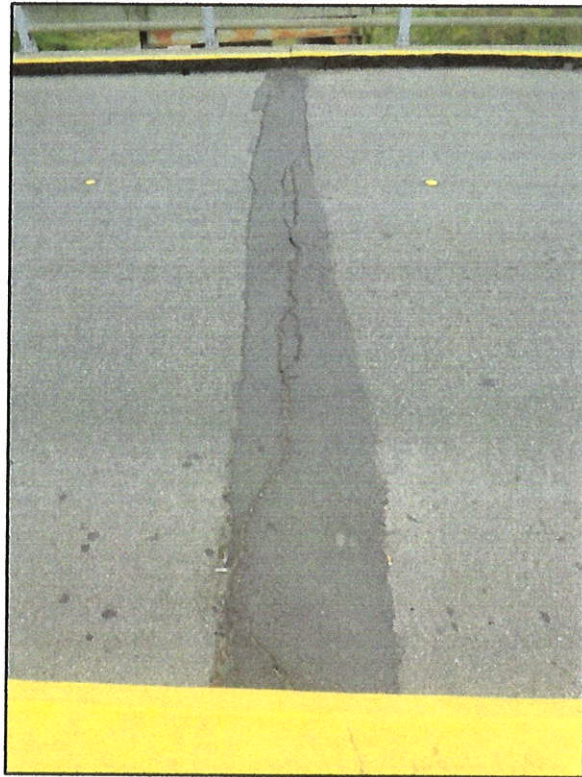


Figure 3.1.2–B (Mexico)



Figure 3.1.2–C (Mexico)



3.1.3 Bridge Drains

The bridge drains are located alongside the curb at the east edge of the bridge roadway. There is various debris and vegetation present in the drains throughout the bridge. Overall they need to be cleaned but are in satisfactory condition. Figure 3.1.3–A shows an example of a drain that warrants cleaning and maintenance.

Figure 3.1.3–A (Mexico)



3.1.4 Curbs and Sidewalks

A concrete curb runs along the east edge of the bridge roadway and a concrete sidewalk runs along the west edge. The curb has minor cracking and spalling at the expansion joint locations. There is also moderate spalling and rebar exposure on top of the curb surface. Concrete spalling is also notable along both edges of the curb. See Figure 3.1.4–A thru C for examples of notable curb damage. The top and edge of sidewalk also has cracking and spalling at the expansion joint locations. The top of the sidewalk has consistent transverse cracking and missing tiles throughout the bridge. There are various areas where the edge of the sidewalk has moderate longitudinal and transverse cracking. Figure 3.1.4–D thru F show examples of sidewalk damage. Overall the curb and sidewalk appear to be in satisfactory condition but will require maintenance in the near future.

Figure 3.1.4–A (Mexico)



Figure 3.1.4–B (Mexico)



Figure 3.1.4–C (Mexico)



Figure 3.1.4–D (Mexico)



Figure 3.1.4–E (Mexico)



Figure 3.1.4–F (Mexico)



3.1.5 Traffic and Pedestrian Rails

The traffic rail that runs along the east edge of the roadway has minimal damage and constructability issues. There is a dent at the top of the rail near abutment 13 possibly caused by vehicle impact (See Figure 3.1.5–A). There is only one area where the rail is misaligned; however, the rail is still functional at this location (See Figure 3.1.5–B). There are various locations where the anchor bolt nuts are not properly tightened to the top of the rail connection plate. Figure 3.1.5–C illustrates an example of this. There is spalling present at the top of the curb where the rail is bolted in (See Figure 3.1.5–D for visual). Overall this traffic rail appears to be structurally adequate and in satisfactory condition.

The pedestrian combination rail (PCR) that runs along the west edge of the roadway has minor honeycombing and transverse cracking throughout. The alignment of PCR is good and no major damage was noted. There is one post connection that does not have any bolts attached located at abutment 13. All other post connections at the top of the rail are satisfactory along with the paint of both the concrete and steel. Figure 3.1.5–E shows an unbolted post connection. Figure 3.1.5–F shows typical PCR honeycombing while Figure 3.1.5–G shows typical transverse cracks on the top of rail. Overall the PCR appears to be in satisfactory condition. Other than the bolts needed for the post connection at abutment 13 there is minimal maintenance needed for this rail.

Figure 3.1.5–A (Mexico)



Figure 3.1.5–B (Mexico)



Figure 3.1.5–C (Mexico)



Figure 3.1.5–D (Mexico)



Figure 3.1.5–E (Mexico)



Figure 3.1.5–F (Mexico)

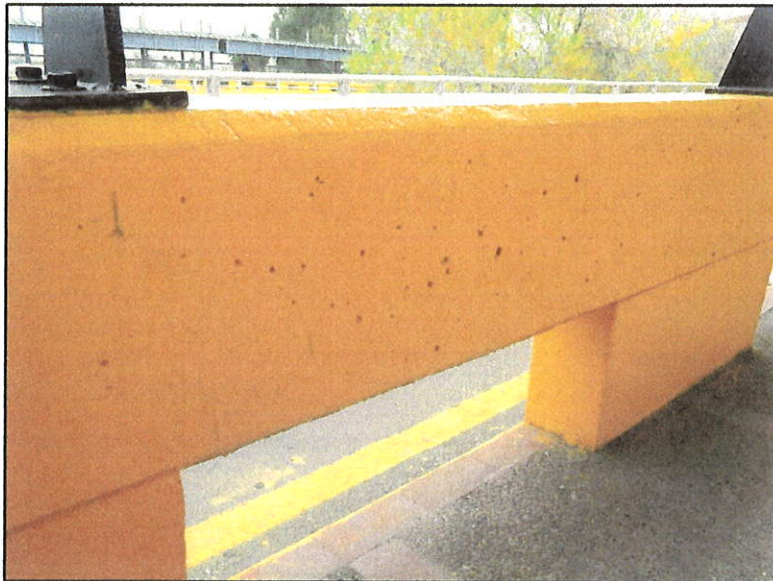


Figure 3.1.5–G (U.S.)



3.1.6 Canopy and Fence

The canopy (Mexico side) and high fence (U.S. side) both appear to be structurally adequate. Amongst the damage noted include missing bottom panels, damaged bottom panels, loose wiring, and concrete spalling around the bolted connections to the sidewalk. There are also areas where the fencing panels are loose or not re-attached properly. The traffic rail behind the canopy and high fence is in very good condition since it has minimal exposure to pedestrians and traffic. There is no notable damage to high fence on the U.S. side of the bridge. Figure 3.1.6–A shows the canopy on the left and the high fence on the right. This marks the border line for the U.S. and Mexico. Figure 3.1.6–B illustrates both a missing panel from the canopy and the traffic rail sitting behind it. Figure 3.1.6–C shows a piece of the canopy fencing that needs to be re-attached properly. Overall the canopy and high fence appear to be in good condition.

Figure 3.1.6—A (Mexico/U.S.)



Figure 3.1.6—B (Mexico)



Figure 3.1.6–C (Mexico)



3.2 Superstructure

3.2.1 Concrete Slab and Diaphragms

Figures 3.2.1-A and 3.2.1-B show a couple of locations at span 7 near abutment 7 where the overhang concrete is spalled off and has exposed rebar. These two areas of spalled concrete and exposed rebar are two of the most severe examples of this type of deterioration on the concrete overhangs. Similar areas with spalled concrete and exposed rebar exist in other areas of the slab and overhangs, but, most are not to the degree depicted in these two figures. On the overhangs it appears that most of the exposed rebar is in the narrow cast-in-place concrete on the edges of the overhangs. The condition of spalled concrete and exposed rebar, although it appears extensive in that it occurs in many areas throughout the bridge, is considered minor deterioration at this time and does not significantly affect the structural capacity of the bridge.

Figure 3.2.1-A (U.S.)



Figure 3.2.1-B (U.S.)



Observation of some of the end span diaphragms revealed locations with exposed rebar on the bottoms of the end diaphragms. Other than some areas with exposed rebar on the end diaphragms, the diaphragms, in general, appear in satisfactory condition.

Bridge drains and canopy base plates protruding through the overhangs were generally in good condition. The concrete in the areas of the drains and base plates appeared in good condition.

In some isolated locations some vertical rebar was observed protruding down from the slab. These rebar were likely left in place during forming of the bottom slab sections.

The joints between concrete slab units and the concrete bent caps were rough in some locations. Figure 3.2.1-C illustrates one such joint as viewed from the overhang soffit. Also shown is some concrete spalling and exposed rebar along and near the joint on the overhang.

Figure 3.2.1-C (Mexico)



At span 10, on the upstream side of the slab and at the joint with bent cap 10, the edge of the slab overhang and bent cap overhang are offset. The edge of the exterior beam below this area of the overhang appears to be in line with the adjacent edge of the bent cap, or only slightly offset. This offset may be due to slight differential displacement or movement between the slab and the bent cap or due to misalignment of the edge of the overhang on the bent cap during construction. Figure 3.2.1-D shows a close up of this condition. It appears that this condition does not significantly affect the structural capacity of the bridge at this time, but warrants close monitoring.

Figure 3.2.1-D (Mexico)

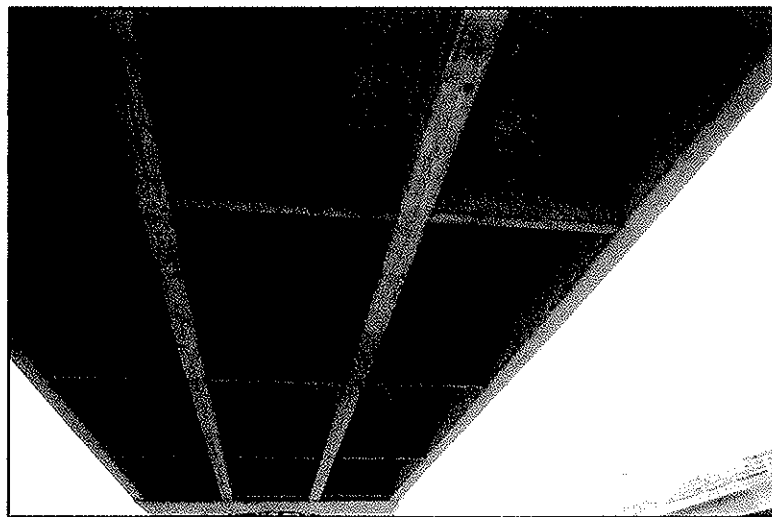


In general, the concrete slab and diaphragms are in fair to satisfactory structural condition.

3.2.2 Beams

The bridge spans consist of a slab span with exterior beams in span 7 and T-beam spans from span 8 through span 12. On the Mexican side of the bridge the bottoms of the beams have many small patches in spans 10 through 12 where it appears that exposed rebar or other deterioration may have been patched and repaired. Some exposed rebar was seen at the bottom of some of the beams on span 9 as shown by the small dark spots at the bottom of the second beam from the left in Figure 3.2.2-A. The exposed rebar is minor deterioration and does not significantly affect the structural capacity of the bridge. Observation of the bearing pads and bearing seat areas was limited to the abutments where observation was still limited due to the confined space. However, observation of the bearing areas did not reveal any problems with the beams. Overall the beams appear to be in good structural condition.

Figure 3.2.2-A (Mexico)



3.3 Substructure

3.3.1 Bearing Seats and Bearing Pads

Observation of the bearing seats and bearing pads was limited to the abutments since no overhead equipment was provided. The bearing pads at abutment 13 appear to be slightly bulging. The abutment 13 cap bearing seat areas have dirt and small pieces of rubble. At bent cap 8 on the downstream edge of the bearing section supporting the exterior beam of span 7 there is some cracking of the bent cap as shown in Figure 3.3.1-A. The concrete at this bearing seat is significantly cracked. There is also exposed rebar in this bearing area. This area of this bent cap is in fair to poor condition and is in need of repair. The bearing seats and bearing pads in all other areas are considered to be in satisfactory condition.

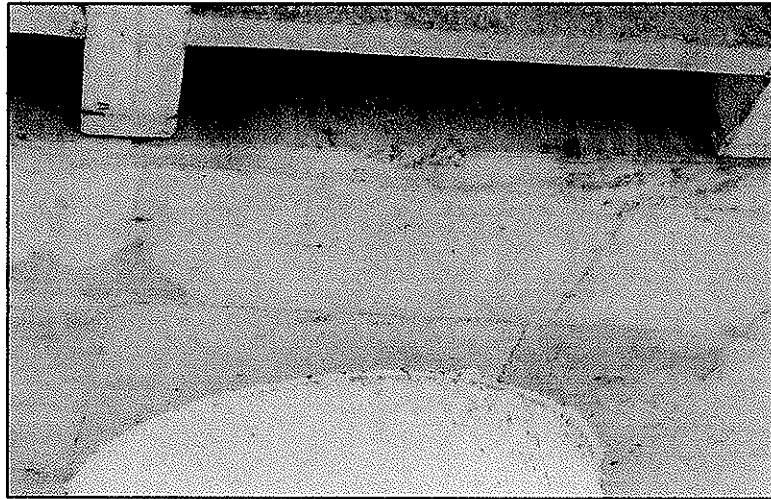
Figure 3.3.1-A (U.S.)



3.3.2 Bent Caps

At bent cap 8 on the downstream edge of the bearing section supporting the exterior beam of span 7 there is some cracking of the bent cap as shown in Figure 3.3.1-A. This area of bent cap 8 is in need of repair. In the same figure, but on the opposite end of the cap, the bottom of the cap is stained. Stains were present to varying degrees on other bent caps as well. On the bottom of the bent 8 cap minor cracks and exposed rebar and honeycombing were observed in some locations. Bent cap 12 has evidence of epoxy injection repair work. Figure 3.3.2-A shows some spalling at the corner and edge of one of the bent caps on the Mexican side of the bridge. Except for the area of bent cap 8 that needs repair mentioned above, the bent caps are generally in satisfactory to good structural condition.

Figure 3.3.2-A (Mexico)



3.3.3 Concrete Columns

The concrete columns did not appear to have any deterioration that would indicate any loss of structural capacity. The concrete columns are in good structural condition.

3.3.4 Abutments

The wingwalls at abutment 7 are cracked. The abutment cap was in good condition except for graffiti throughout. There was no evidence of any problems with the abutment backwall. At abutment 13 the abutment cap has dirt and small pieces of rubble on it. The backwall appeared to be in good condition.

The wingwalls were in satisfactory condition. The abutments are generally in satisfactory structural condition.

3.3.5 Foundations / Settlement

The concrete columns are supported on deep circular footings. The existing ground at the bases of the columns did not show signs of scour or erosion significant enough to affect the structural capacity of the foundations. No appreciable settlement was observed from below the bridge. However, observations from the top of the bridge of adjacent concrete elements that appear to be offset from each other indicate that some differential settlements may have occurred. At the abutments some minor settlement of the ground is evident beneath the abutment 7 cap and at abutment 13 based on observation of a small gap between the riprap and the abutment cap. The foundations are in good structural condition.

4 Structural Inspection (Downstream Bridge—Northbound)

4.1 Roadway – Top of Bridge

4.1.1 Bridge Deck

There are visible cracks at the joint locations in the asphalt overlay. The wear of the deck surface appears to be considerable. There are numerous ruts located near the bridge joints throughout the bridge. Also, the lane stripes are intermittent and lack consistency throughout the bridge. Nonetheless, the asphalt overlay still appears to be structurally adequate and in satisfactory condition. Figure 4.1.1–A shows an overall view of the deck while Figure 4.1.1–B shows the asphalt cracking found at the joint locations. Figure 4.1.1–C illustrates examples of the ruts in the asphalt.

Figure 4.1.1–A (Mexico)

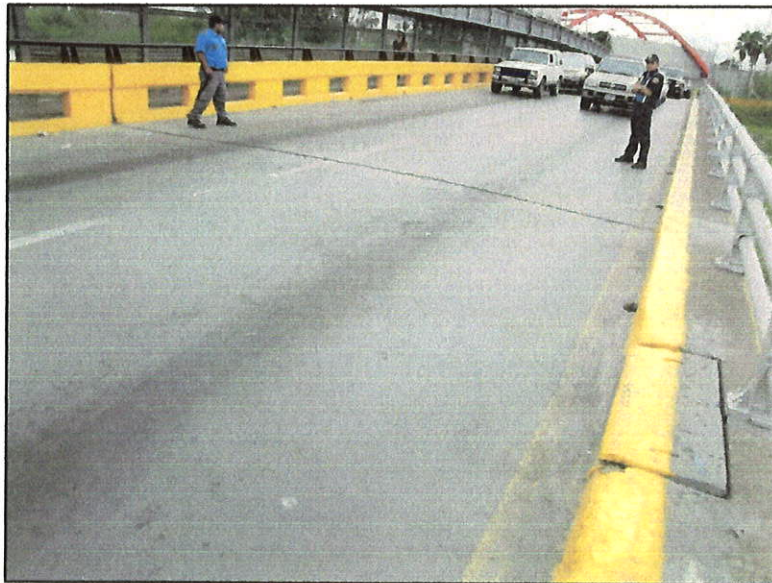


Figure 4.1.1–B (U.S.)



Figure 4.1.1–C (Mexico)



4.1.2 Bridge Joints

Expansion joints are only visible along the width of the roadway since the concrete curb and sidewalk cover them along the edges of the bridge. We are not able to inspect the expansion joints at bent 5 and abutment 6 (U.S. side of bridge) since they are covered with asphalt overlay. There are transverse cracks in the asphalt overlay covering these joints. The expansion joint at abutment 6

is slightly visible due to the wearing of the deck at this location. The asphalt overlay at these joints restricts bridge movement which adds additional loading to the other bridge elements, thus potentially reducing their structural life. As for the remaining expansion joints, they are filled with debris and trash; nonetheless are in good condition. All joints are properly aligned and do not show any major signs of damage. Although there is notable spalling and cracking on the curb and sidewalk at the expansion joint ends the negative effects on the joint alignments is minimal. Figure 4.1.2-A shows an example of an asphalt covered expansion joint at Bent 5. Figure 4.1.2-B shows a typical uncovered expansion joint. Figure 4.1.2-C shows the damaged end of the expansion joint at bent 4.

Figure 4.1.2-A (U.S.)



Figure 4.1.2-B (Mexico)



Figure 4.1.2-C (Mexico)



4.1.3 Bridge Drains

The bridge drains are located alongside both the curb at the west edge of the bridge roadway and the sidewalk along the east edge of the roadway. There is various debris and vegetation present in the drains throughout the bridge. Overall they need to be cleaned but are in satisfactory condition. Figure 4.1.3–A shows an example of a drain that warrants cleaning and maintenance.

Figure 4.1.3–A (Mexico)



4.1.4 Curbs and Sidewalks

A concrete curb runs along the west edge of the bridge roadway and a concrete sidewalk runs along the east edge. The curb has minor to moderate cracking and spalling at the expansion joint locations. There is also minor to moderate spalling and rebar exposure on top of the curb at various locations throughout the bridge. There is a curb cut out located above bent 4 (unsure of its intended purpose) that has moderate spalling and rebar exposure. Concrete spalling is also notable along the inside edge of the curb. See Figure 4.1.4–A and B for examples of notable curb damage. Figure 4.1.4–C shows the curb cut out. The top and edge of sidewalk also has cracking and spalling at the expansion joint locations. The top of the sidewalk has consistent spalling and transverse cracking throughout the bridge. Because of the excessive wear to the top of the sidewalk the surface is not smooth and noticeably uneven. There are various areas where the edge of the sidewalk has minor longitudinal and transverse cracking. Figure 4.1.4–D and E show the excessive wear to the top of the sidewalk (U.S. side of bridge). Figure 4.1.4–F shows edge of sidewalk cracks.

Overall the curb and sidewalk appear to be structurally adequate and in fair to satisfactory condition but will require maintenance in the near future.

Figure 4.1.4–A (Mexico)

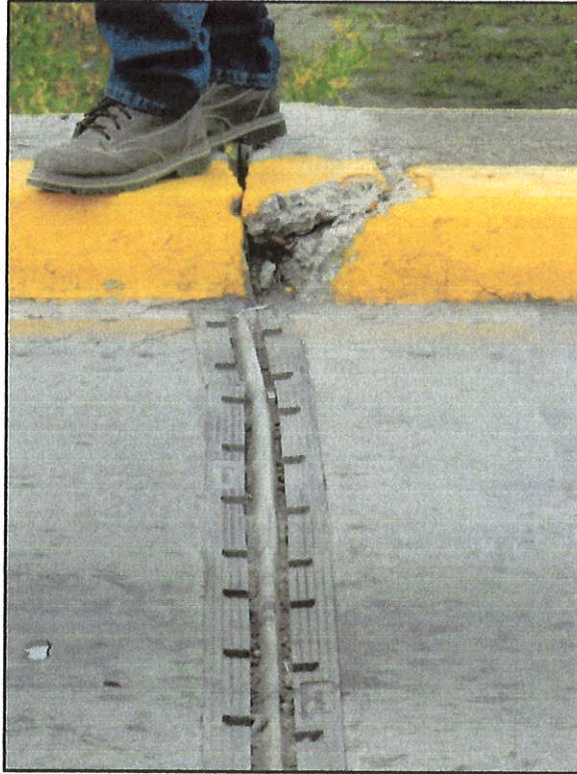


Figure 4.1.4–B (U.S.)



Figure 4.1.4—C (Mexico)



Figure 4.1.4—D (U.S.)

